A

# TREATISE

ON THE

CAUSE OF THE DISEASE CALLED BY THE PEOPLE

THE

# MILK-SICKNESS;

AS IT OCCURS IN THE

WESTERN AND SOUTHERN STATES.

---

BY JOHN SIMPSON SEATON, M. D.,

OF JEFFERSON COUNTY, KY.

---

LOUISVILLE, KY.

PRENTICE AND WEISSINGER.

1841.

UNITED STATES OF AMERICA, }
*District of Kentucky, Sct.* }

BE it remembered, that on the 22d day of July, A. D., eighteen hundred and forty-one, JOHN SIMPSON SEATON, of the said District, deposited in this office the title of a Book, the title of which is in the words following, to-wit:

"A Treatise on the cause of the disease, called by the people the MILK-SICKNESS, as it occurs in the Western and Southern States: by JOHN SIMPSON SEATON, M. D., of Jefferson County, Ky."

The right whereof he claims as author and proprietor, in conformity with an Act of Congress, entitled an "Act to amend the several Acts respecting Copy Rights."

JOHN H. HANNA, C. K. D. C.

# A TREATISE

ON THE

# CAUSE OF MILK-SICKNESS.

---

It is the imperative duty of every physician who properly esteems his profession and duly appreciates the responsibilities which his pretensions necessarily impose upon him, to read of disease, think of disease, observe its different phases and mutations, and, in all cases to which importance attaches, to make known the results of his observations and researches.

This premise is true, in relation to the demands which the profession claims from the hands of all its members in a general sense; but it is especially so, relative to those diseases, the cause or causes of which is either ambiguous or obscure. When a disease is apt to occur frequently we should be acquainted with the cause that gives it origin, in order to be enabled to adopt such remedial measures as will lead it to a favorable termination—or if a malady occur but occasionally, with symptoms characteristic of malignity and consequent danger, it is equally important that we understand its cause, that we may remove it the sooner, and by so doing quell the effects. But when a disease is of very frequent recurrence, and that, too, combined with and characterized by highly malignant and dangerous indications, and the issues prove that those indications are worthy of our confidence, and not delusive, a much weightier importance attaches to our knowledge of the whole—cause, symptomatology, and pathology. Notwithstanding, we are compelled to treat many diseases without being

possessed of a thorough and well defined understanding of their proximate or immediate causes; yet, when we can attain to a full and complete knowledge of the cause of a given ailment, our chances to arrest the course of morbid action are greatly enhanced, as we are thereby enabled to adopt and bring into requisition a more rational and philosophic adaptation of therapeutic applications, founded upon first principles.

We have in the disease which I intend to consider in this paper, one that often prevails in many localities throughout the Western and Southern members of the United States, and which, in most of its features, presents a most unrelenting and fatal character: hovering as it does over many fair portions of our otherwise happy and delightful country, it lights upon the inhabitants of those regions, and sits like a blighting curse upon the ground, calling to our remembrance the fearful visitations of the Almighty's condemning judgments in days of yore, upon the hardened and relentless hosts of Pharaoh.

The milk-sickness or endemic sick stomach, has for a long while been familiarly known to the inhabitants of many localities throughout the Western and Southern States, and has annually destroyed the lives of many of the settlers in those districts, together with the lives of immense numbers of the inferior animals of various kinds, which constitute an important part of the pecuniary wealth of western and southern farmers.

The time that has elapsed since cognizance was first taken of the disease, cannot, perhaps, be ascertained with precision. I have conversed with several gentlemen who assert, that they have seen newspaper notices of it, or a disease nearly allied to it, having at sundry times occurred in different portions of the Old World, and we are told that Linens, in his tour through Lapland, discovered or thought he discovered a plant that proved deleterious to horned cattle, &c.; but, whether the disease has ever been witnessed indeed, in any other country or quarter on the globe, except those portions of the United States above mentioned is uncertain, in as much as all the testimony

on the subject of its having occurred in other and remote portions of the earth, is but light, irregular, vague, and unsatisfactory; hence, I will confine my considerations of it, to the limits within which, in point of time and place, it entered and has remained in the annals of medical or professional record.

The first observance of the disease, reported from the press, emanated from a Dr. Barbee, of Virginia, who made observations and collected some accounts of it, while on a visit to the Mad River country in the state of Ohio, in the Spring of 1809, a short sketch of which, as detailed by him, was published in 1810 in a small pamphlet, entitled "Notices Concerning Cincinnati." This same sketch, though short and imperfect, was subsequently transferred to the pages of the Western Journal of the Medical and Physical Sciences, edited by Daniel Drake, M. D., and can now be read, by any who may wish to do so, by referring to the fourth number of the third volume of that periodical.

One prominent fact will be discovered by reading and comparing this short sketch, published from the information given by Dr. Barbee in 1810, with the numerous treatises, which, during the lapse of time, from that period to the present, have from time to time issued from the press, penned by different and numerous observers, located at the many different points throughout the South and West. It will be seen that the same symptoms that were enumerated by Dr. Barbee, and which awarded to it *then*, the consideration of a *new disease*, or one *sui generis*, have continued to characterise the ailment up to the present day: the only mutation that the catalogue of symptoms, as given in the first published account has undergone, is, that some others have been noticed and appended which did not find place in the first treatise. The same prominent diagnostic indications however, that were observed to characterize the ailment at first, have continued present to the last publication on the subject, which was from the pen of Professor Drake, of Louisville, in the early part of the present year. The fact that other symptoms, besides those that were first given, have been

observed and reported from time to time, is no new occurrence, nor is it peculiar to any disease; for, in the first place, there is scarcely any one man who will be so accurate as to report all the minutiæ of the symptomatology in any one given case of disease. Very often *one* will pass by symptoms unobserved, while a second or third will detect them; secondly, time must be had, and different individuals must be afflicted with any form of disease that is new, before all the minor indications can be summed up that attend it. Hence there is nothing to excite our astonishment in the fact, that, in the subsequent essays, symptoms have been noted that were not mentioned in the first. But the circumstance of all having concurred in the leading and prominent features of the disease specified in 1810, in the publication then made, I think, justly warrants the conclusion that the cause of the disease is fixed, definite, and specific; and that whatever causes it to appear in Ohio and Indiana, also does, in Kentucky, Tennessee, Georgia, the Carolinas, &c.

The cause of the disease has been the inscrutable mystery. That it is a poison of reputed virulence, no one who has either seen or read of the disease can for a moment doubt, and the world has been full of conjectures on the subject ever since it began to prevail. Many agents have been charged with the mischief done; almost every thing that appertains to the South and West, the properties of which were not known, have in the course of time been censured; and indeed, such has been the rage for wild and extravagant conjecture that we are almost astonished to find that lunar influence has escaped the charge, and that the Moon has not been persecuted and denounced as the source of this mortal plague.

Much time and labor have, however, been spent with zeal and energy worthy of *philanthropists*, in endeavoring to ferret out the cause of so great mortality; but all the efforts to effect so desirable a purpose, have, as yet, been unavailing, at least unsatisfactory. I doubt not, however, that our spies have often entered the encampment of this enemy, have crossed and recrossed its redoubts, and trampled un-

der foot, its formidable ambuscades, while it laid so secretly entrenched as to elude detection. During the entire range of conjecture, dignified by the appellation of "investigation," a trilemma has uniformly presented, upon each horn of which, many have hung, and on one or the other of them they have invariably suspended. In other words, three opinions have been rife, relative to the cause of the Trembles, milk-sickness, &c., and each one has had its votaries, and all have been urged and supported by men of acknowledged talents and professional distinction.

The first occupies the ground that the cause of milk-sickness is a product of the vegetable kingdom, that the herb or herbs, are eaten by the cattle, or animals, and disseminated through their systems, and thus, render the flesh, milk, butter and cheese poisonous, and consequently destructive to man, as well as all inferior animals that chance to partake of either.

The second position is, that the cause is contained in the atmosphere, and depends upon some poisonous exhalation from the earth, or is generated in *miasmatic* districts where malarious effluviæ are known to abound by the prevalence of other diseases known to be the product of miasmatic effluviæ, that, in this form, the poison is taken into the system by the performance of the respiratory functions, and that in this way, the flesh, milk, butter, &c., become contaminated. I cannot give the reasons which are advanced in support of these different positions by their respective votaries, for, that would occupy more time and space than I feel disposed to dedicate to such a purpose, and would also be too wide a departure from the object before me.

The third opinion maintains the ground that the cause of the disease under consideration, is resident in the mineral kingdom, and that the streams of water passing through those substances, imbedded in the earth, dissolve, and hold in solution enough of the noxious agent to render the springs and rivulets in the vicinity of such materials, poisonous, and in this way is taken into the system. Some suppose that exhalations rise from mineral substances, and render the air poi-

sonous; while others contend that mineral substances rise in vapour, are condensed, and precipitated upon the vegetation in their neighborhood, and thus render it the destroyer, when taken into the stomachs of those animals that feed upon it.

Some again have written lengthy and labored treatises upon the disease, its distinguishing features, the treatment necessary to its cure, and in the end have arrived at the *philosophic* and *sage* like conclusion that the cause is not, and probably never will be known.

A few persons could be found who were once skeptical on the subject of the existence of the disease; but at the present day, I presume but few, if any, especially in the South and West, could be found who would hazard the assertion of their infidelity in relation to its existence.

I am therefore not disposed to endeavor to prove its existence, as I am persuaded that this has already been done to the entire conviction of all, and that on that head but little could be said, more than has already been advanced; consequently, I will speak of it as it is, supposing that all understand and acknowledge its distinguishing peculiarities.

Such has been the conflicting state of opinion relative to the cause of the disease, while all have concurred in detailing the symptoms that distinguish it.

This insidious enemy to animal life has had a long and successful reign, being so completely covered by the dark shades of its own retreat, as to entirely evade detection by the numerous and diligent searches that have been made for it, and it is now justly viewed with unmitigated terror by the inhabitants of those districts, known to be subject to its invasions.

Notwithstanding the darkness that has prevailed on the subject, and the unavailing efforts for its discovery, I believe the time has arrived when the subject will be stripped of its mystery, and the lurking place of the monster be entered and laid open to common observation.

I have for a considerable length of time believed that the disease was dependent upon the mineral kingdom for its origin; and I have also believed it to be a particular member of the mineral family that caused the disease; and, of course, I have availed myself of all the information that I could obtain upon the subject for the purpose of testing, as far as possible, the truth of my position, and the result is, that I have been sustained in my views on the subject by the best testimony that I have been able to collect, as I think will be clearly shown in the following pages. I am fully aware of the consequences to which any man will probably be exposed, who is bold enough to assert that any one article or substance in Nature's vast dominion, is the agent that causes this appaling form of disease, and nothing short of a thorough conviction of the immutable truth of the position that I occupy, could induce me to append my name to such a publication: but, knowing that the matter is susceptible of positive demonstration; and wishing to engage strict analysis and close investigation, believing that the position will bear the scrutiny, and be sustained in the end, I willingly risk the annunciation and incur the responsibility.

Many writers have stated that they could discover no botanical nor geological peculiarities which could distinguish those districts, which afford the cause of the ailment, from those in which it does not occur; and I heartily concur in relation to the botanical features of the different sections. But I differ with them materially on the geological aspect presented. So widely do I differ in this sentiment that I would engage to go through many of the States, and locate portions of land that would afford the milk-sickness, and portions that would not, under a penalty of a heavy forfeiture, if I failed essentially in the selection of either—and my decisions would be based upon the geology in each case. I feel warranted in saying, that there are geological indications which, if attended to, will invariably insure safety from milk-sickness. These geological distinctions should be known, for they are and will remain of prime and last-

ing moment to persons intending to locate land in regions of country which have not been tested by the experience of residents or settlers.

Where limestone occurs generally and in place, the milk-sickness will not show itself. I mean exclusive lime-stone regions. Where good pure limestone is the original as well as the general formation, the disease in question will not obtain. In all the milk-sick districts that I have been able to see or obtain information from, this characteristic is wanting; and I have never been able to hear of the occurrence of a single case in such sections. Where lime and sandstone occur together, the disease sometimes prevails; but in the entire freestone districts the disease prevails most abundantly. This does not, however, account for the cause of the malady; for we do not suppose that either limestone or freestone can, *per se*, be the cause. Hence, we require further information on the subject; and, to make the matter as plain as possible, I will give it a different statement, which will render it clearer, premising, however, that a mineral or minerals must be present.

First, then, the pure limestone regions are exempt. Second; a mixture of lime and sandstone with mineral substances does sometimes afford the disease; but, thirdly, the pure sandstone formation connected with the ores of metals, is the distinguishing geological feature of those regions where the disease is most abundant.

It is worthy of remark here, that the sandstone regions of the coal formation, generally contain, more or less, of a harder formation, of stone, which is either the secondary limestone, or a species called, in common parlance, bastard limestone; but from which, no good lime can be obtained. We find in the milk-sick regions, generally, the freestone to be the principal formation, with more or less of the harder kinds just mentioned, often slate, more or less dense and brittle, indurated clay, commonly called soapstone, stonecoal, &c. These may, or may not, all be present together; but more or less of them, combined with minerals, can always be found in regions where the milk-sickness prevails to any extent.

To any who may wish to study at length the different formations of stone, I would recommend Philips on Mineralogy.

When these geological differences are recognized, the atmospheric and botanical theories must go by the board, for we cannot reasonably suppose that nature would be so partial in her distribution of noxious plants, as to select such sites as are above named, and such only, for the one that would cause the trembles or milk-sickness, and that there it should entirely escape from detection. And to imagine that the stock ranging in such localities, would select this fearfully poisonous plant for food, while those grazing on good pure limestone lands would sedulously avoid it, when it could be as easily gathered there as in the milk-sick quarters, would be a *splendid* absurdity. But the botanists admit that there is no botanical peculiarity to distinguish the milk-sick districts from those that are exempt, and I believe them.

A host of experiments have been made on the different inferior animals, with different plants and herbs, that were suspected to be the mischief makers; but in no single instance has any such plant, or herb, which contained any very poisonous principle, such as would destroy the life of the animal, been got into the stomach in any other way, than by *dire compulsion.* Although they have in this way succeeded in destroying animals, it rather proves that those substances, thus forced upon the poor brutes, cannot be the cause of the trembles, for if the animals had been left to the exercise of their own instinct, or inclinations, they would not have eaten the plants, and, consequently, would not have been injured by them. It is a fact, known to every one, that there are vegetable substances which will destroy animal life, when introduced into the system in sufficient quantity; but we know, also, that the dumb animals avoid such as certainly as we do. Indeed, we cannot believe that so many animals, as annually and even semi-annually die with, or are more or less affected by the trembles, would commit such gross and glaring departures from that instinctive certainty with which they select the innocent and nutritive herbage, from that of so widely opposite a quality, even if any such did

exist; but I say emphatically, that no such vegetable product does exist, and I challenge the botanists to produce it.

It will be borne in mind that, notwithstanding many different animals have been killed, by the tentative administration of various products of the vegetable kingdom, yet there is not an instance recorded, in which, the mortality extended beyond the immediate subjects of the experiments, and I will say, that not one article, in the annals of botanical history can be found, to produce the effects in question, viz: that will destroy the lives of horses, cows, sheep, &c. and the flesh of these destroy all other animals that eat of it, with identical symptoms with the originals.

It is a fact, which the experience of almost every farmer can attest, that animals, feeding upon the carcasses of those that have died of different ailments, and whose flesh, &c. is in a state of partial rottenness and consequent decomposition, will sometimes be destroyed by it. This is especially true of hogs that feed upon the bodies of cattle that have died with the *murrain;* and upon this source I am disposed to depend as much, in accounting for the fact that hogs die from eating milk-sick cattle, &c., as upon the specific poison that causes the milk-sickness.

From the above facts, and the circumstance, also, that this noxious agent differs so widely from the laws that govern all the known vegetable poisons, I cannot be induced to believe that a vegetable is the cause of the disease; but I am not prepared to deny, that vegetation may sometimes be the vehicle through which the poison finds its way into the stomachs of animals, as will be seen in another part of this treatise. I will here again decline going into a detail of the different plants which have been submitted to experiments, the symptoms that they produced, and the pathological manifestations that were noticed, &c., on the ground, that Professor Drake of Louisville, gave most of them a just consideration, in his publication on the subject, in the third number of the third volume of the Louisville Medical and Surgical Journal.

In this memoir, Dr. Drake reviewed the experiments with the different species of Eupatorium, Bignonia, Fungi, and at least one of the Rhus, and showed conclusively, that they could not, in all probability, be the producers of the disease in question. But while Professor Drake was, I think, successfully disproving the ability of the above named articles to produce the malady, he at the same time was disposed to attribute the mischief to another, of equal, if not greater impotency than some of those that he condemned.

For the consideration of those who may be disposed to regard the Rhus-Toxicodendron as the article that causes the milk-sickness, I will state a few facts relative to it.

This Rhus-Toxicodendron, poison-vine, or poison-oak, as it is commonly called, grows as abundantly in Jefferson county, Ky., as in any other section that I have ever seen, and the stock has free access to it; but yet milk-sickness was never known to occur in the county. Again, my father lived on one of the principal tributary branches of Salt River, and the Rhus grew exuberantly in the fence rows bordering on the creek, and I have often seen the cows and the horses on the place eat the leaves and tender branches of the vine, without being in the least injured by them, and we at the same time used the milk, butter, &c., and yet we never heard of the disease in the county, much less in our own family. While sitting writing there are several large vines of this kind in sight of me, with the leaves and lower twigs eaten off by the cattle, and yet no milk-sickness. While on a recent tour through some parts of Indiana, in company with Mr. A. Low of Louisville, we were informed by several gentlemen that this substance had frequently been successfully administered as a remedy for the trembles in cattle; they stated that it uniformly succeeded in relieving when it was employed as soon as the cattle were discovered to have the disease.

I will remark, however, that the Rhus is exceedingly scarce in this section of the country, which is on the waters of Beaver Creek, in Lawrence county, and which will be spoken of at length in another

place; and notwithstanding the great sparseness of the Rhus-Toxicodendron in those regions, yet the milk-sickness threatens the depopulation of that portion of the state.

In view of the above facts, relative to the Rhus-Toxicodendron, we cannot believe it to be the cause of trembles, milk-sickness, &c. &c., unless we subscribe to the doctrines of the recent reformers in medicine, (the Homœpathists,) and contend that whatever will, a priori, cause any given disease, will also cure the same.

I hope this will obtain for the Rhus a quietus, and with it, also, the whole catalogue of vegetable substances.

The theory that supposes the cause to be atmospheric, will receive a short notice again, and will then be discharged. We cannot suppose that situations, distinguished by the geological features before mentioned, and those alone, could be capable of generating an invisible noxious agent, that would cause a disease with such fearful consequences. There is no peculiarity of aspect that should give to those districts such unrivalled precedence. And notwithstanding those diseases do obtain in the milk-sick regions, which are admitted to be of miasmatic origin, yet they do not abound to a greater extent, than they do in very many localities where the milk-sickness is not known. Again: milk-sickness very often obtains, where the miasmatic diseases do not appear in a corresponding ratio, as in the dead of winter, the spring, and early summer months, &c. &c. They differ in another essential feature, viz.: during dry seasons the milk-sickness abounds most, uniformly, at all points, while it is generally the more low and marshy situations only that suffer with the different forms of malarious diseases at such times. In very wet seasons, the milk-sickness occurs but very rarely, while the higher lands suffer most with the miasmatic ailments. Here is a distinction of manifest prominence, when we reflect, that milk-sickness is as much the plague of the high, as it is of the low lands, as it shows itself in regions which are more or less broken and irregular.

In complete corroboration of my views on the subject, it is stated

by some that, since the prevalence of milk-sickness, miasmatic diseases have been observed to decline in the districts where it abounds. In the first essay on the subject, this fact is mentioned, as follows: "It however prevails (though not exclusively) in aguish situations, and intermitting diseases are thought to have declined since its appearance."—Western Journal of Medical and Physical Sciences, Vol. iii, No. 4, page 484.

I had a short, but very pleasant interview with Dr. John M. Rilie of Orleans, in Indiana, while on my recent tour through that state, and he informed me that he had practised for twenty years at Hardinsburg in Kentucky, and during that time he had attended a great number of cases of milk-sickness, and upon the whole, he did not think that persons, who were affected by the milk-sick poison, were as liable to intermitting diseases as those that were not. I also conversed with Dr. Cornelius White of Paoli, an extract from whose inaugural dissertation, on the subject of milk-sickness, is reported in the first number of the ninth volume of the Transylvania Journal of Medicine. Dr. White was, however, unable to decide on its propholactic influence in intermitting diseases. I conversed on this subject with many of the farmers in Lawrence county, and they almost unanimously concurred in the opinion, that intermittents had declined since the prevalence of the trembles, or milk-sickness.

For these, with many other reasons which will follow, I cannot believe the cause of the disease in question, to be resident in the atmosphere; hence I will, for the present, acquit both the atmosphere and vegetation, and will probably arraign them no more. I will, however, before quitting this part of the subject, suggest to those who have both time and animals to sacrifice to experimenting, that if they will use any of the soluble salts or admixtures of arsenic, that thereby they may, by the different modes of administration, produce the disease with all the wonted and characteristic symptoms; for I am fully persuaded, that *arsenic* is the proximate and direct cause of trembles, or sick-stomach.

This proposition is clear and definite, and I shall endeavor to sustain it by the best proof that I can bring to bear in the following pages; but I will not attempt to prove that other mineral substances do not enter into the stomachs of the different animals with the arsenic, and even modify the symptoms, in some cases; but that arsenic is the agent that produces the disease is the premise, without denying either that other minerals do enter with it, or that they do, in some instances, modify the morbid manifestations.

In looking at a treatise on the disease, contained in the seventh number of the first volume of the Western Medical and Physical Journal, from the pen of Guy W. Wright, M. D., I find a principle laid down for conducting such investigations, which I think is a good one, and will, therefore, insert it in Dr. Wright's own words, which are as follows:

"In the investigation of all anomalous diseases, where the cause is unknown, or very obscure, the most phylosophical course of inquiry is, first to consider its analogy to those known diseases to which it bears the greatest resemblance, and then, if the treatment will sustain the comparison, it is circumstantially proved that there is a proportionate relation in the cause of either."

Now I propose, as far as practicable, to try the disease under consideration by this rule, and in order to render comparison as striking as possible, I will insert the symptoms of poisoning with arsenious acid, or white oxide of arsenic, and as the most lengthy and full catalogue, that I have met with, is contained in the United States Dispensatory, by Wood & Bache, I will report from that as they are there laid down.

"1, austere taste; 2, fetid state of the mouth; 3, frequent ptyalism; 4, continued hawking; 5, constriction of the pharynx and œsophagus; 6, the sensation of the teeth being on edge; 7, hiccups; 8, nausea; 9, anxiety; 10, frequent sinkings; 11, burning at the precordia; 12, inflammation of the lips, tongue, palate, throat, and œsophagus; 13, irritable stomach, so as to be unable to support the blandest drinks; 14, vomiting of matters, sometimes brown, at other times bloody; 15,

black horribly fetid stools; 16, pulse small, frequent, concentrated, and irregular, occasionally slow and unequal; 17, palpitations; 18, syncope; 19, insatiable thirst; 20, burning heat of the body, or a sense of icy coldness; 21, difficult respiration; 22, cold sweats; 23, red and bloody urine; 24, change in the countenance; 25, a livid circle round the eyelids; 26, swelling and itching of the body; 27, livid spots over the body, and occasionally, a miliary eruption; 28, prostration of strength; 29, loss of feeling, especially of the feet and hands; 30, delirium; 31, convulsions, often accompanied with insupportable priapism; 32, falling off of the hair; 33, detachment of the cuticle, &c." The authors then remark: "It is very rare to observe all these symptoms in the same individual. In some cases, indeed, they are nearly all wanting, death taking place without any pain or prominent symptom."

We find in the above thirty-three symptoms, enumerated as characteristic of poisoning with the one particular compound of arsenic in substance, which is the longest list I have seen in any work, and which have been summed up from a great many cases.

I will now give the symptoms of two cases of milk-sickness as detailed by Dr. L. F. Sharp, of Hartsville, in Tennessee, in 1822, in a letter to Dr. Alexander McCall on the subject. The symptoms of the two cases are detailed together: 1, a moderate burning in the stomach; 2, severe burning of the stomach; 3, severe vomiting; 4, obstinate constipation; 5, pulse small, thready, a little accelerated; 6, extremities cold; 7, tongue tremulous, and covered with white mucus; 8, restlessness; 9, great anxiety; 10, ungovernable thirst; 11, inability to retain fluids on the stomach, and pain and vomiting increased by throwing them from the stomach; 12, great prostration; 13, hiccup; 14, inspiration slow and difficult; 15, stupor; 16, insensibility; 17, pulse intermitting, &c. &c.; death. Such is the history of those cases which occured in July, 1814, and was detailed from notes then taken, in November, 1822, better than eight years from the date of their occurrence. He says: "the stomach and bowels seemed

to be the seat of the disease, and as constipation was present, and the stomach very irritable, we may safely suppose tormina to have been present, which would constitute another symptom of arsenical poisoning. But Dr. Sharp says: "The tongue was tremulous, and covered with a white coat," while Wood & Bache say, "it is red and inflamed."

In the first number of the third volume of the Louisville Medical and Surgical Journal, there is a detailed account of a family, consisting of eight persons, who were poisoned with arsenic, and in each case the white coating was upon the tongue.

This then reconciles the difference at once, as it shows conclusively that the white coat will appear upon the tongue in both cases; but we will see that the red and inflamed tongue has been observed in milk-sickness also. Here follows a history of the symptoms by G. W. Wright, M. D., whose paper has before been noticed. Dr. Wright says: "Constant nausea and vomiting, a burning sensation from the stomach up the œsophagus to the mouth, accompanied with insatiable thirst, the breath and matters vomited have a disagreeable pungent odour, obstinate constipation of the bowels, great muscular prostration, restlessness, hypocondriacal gloominess and fear of dying, anxiety, laborious respiration, the *tongue* generally exhibits a yellow fur in its middle, the edges appearing red and shining, pulse often regular and full, though sometimes a little increased in frequency, and somewhat tense and wiry, the voice is frequently impaired, so that, in ten or twelve hours from the attack, the patient is unable to speak above a whisper."

Such are the symptoms of milk-sickness as reported by Dr. Wright, and they correspond admirably with those caused by the exhibition of arsenic; indeed, it is a fuller account of the symptoms produced by arsenic than we often get, when the subject is treated of directly. Here we notice the red tongue; but says one, the bowels are habitually constipated in milk-sickness, while in arsenic, Wood & Bache say, they are open, pouring off black and horribly fetid evacuations. How shall

we reconcile this discrepancy? We will hear the testimony of several on this subject. Dr. Wright says: "During the years 1821–2, I had three several cases in one family, one the first year and two the second. A few of the other members of the family, during the first year, had the bilious intermitting or remitting fever, and on the second a number had dysentery, and two, a son aged 20, and a married daughter, had the sick-stomach. The son was first seized with sick-stomach, and before he recovered his strength was violently attacked with dysentery, of which he died." Now there is high probability that this son, who died apparently of dysentery, after an attack of the sick stomach, was in reality carried off by the cause that gave him the sick-stomach, for arsenic (which we contend is the cause of sick-stomach) will some times simulate dysentery, especially when introduced into the system gradually. By reference to Paris' Pharmacologia, Vol. ii, page 71, we there find that convulsions, gripes, and bloody stools, are occasioned by the fumes of arsenic; and on page 73, we find an account of strangury having been caused by its gradual internal exhibition, while Eberle, in his therapeutics, declares that it causes painful diarrhœa in over portions; and when we consider these facts, we see ample grounds for supposing that this young man, of whom Dr. Wright speaks, to have been thus affected, as well as the other dysenterics of the family, suffered by the cause of milk-sickness, or arsenic; but we have other facts that are more in point, and we will recur to them at once.

Dr. Sharp, in his letter to Dr. McCall, details the case of a Mrs. Jones, which occurred in 1818, which is case fifth in his letter. He speaks thus of it: "Mrs. Jones was taken on the 26th of April, 1818, with slight burning at the stomach, which increased for three days, when severe burning and some pain were felt. She often vomited and had frequent alvine discharges for two or three days more; her bowels then became obstinately costive, &c."

Here we find the disease ushered in with vomiting and frequent discharges from the bowels; and from the symptomatology by Wood & Bache, we would suppose this characteristic of poisoning with arsenic, though it was a genuine case of milk-sickness.

Dr. Sharp remarks further on this case and says: "I was called on the third day of her indisposition; I bled her and commenced giving 20 grs. of calomel every fourth hour, using in the meantime cathartic injections. In about twenty-four hours she passed dark scybalous fæces, mixed with blackish bloody matter, &c."

In the commencement of this case, we had frequent alvine evacuations for two or three days, then constipation succeeded, and when this was overcome, we had dark scybalous fæces mixed with blackish bloody matter.

I conceive that enough has been advanced already to satisfy any impartial observer in relation to the condition of the bowels in the two ailments; but as obstinate constipation of the bowels is set down as one of the distinguishing features in milk-sickness, and a state of the bowels rather different from that, is supposed to attend cases poisoned by arsenic, I will again refer to the reported cases in the first number of the third volume of the Louisville Medical and Surgical Journal. This family, as before stated, consisted of eight persons, and resided in the city of Philadelphia. The family all partook of the pudding that contained the arsenic; two of them died, while the others recovered, by the free use of the hydrated peroxide of iron.

Of the two that were destroyed we have a full account, both of the symptoms and pathology. The first died seven hours after eating the poison, and the other in nine hours from the same period; both died without the bowels having been acted on; and there is nothing said to lead to the belief that either of the others were purged to any extent; and in one case it is mentioned that, on the second day, there was no purging. This is all that is mentioned in relation to the bowels of any of the six that recovered, and it is not supposable that the bowels could have been in any way seriously affected, without their being noticed by the reporters.

Now I think I have said enough to entirely reconcile the difficulty as regards the condition of the bowels in the two affections. First, it is stated by wood and Bache that the bowels cast off black and fe-

tid stools from arsenic; but that all the symptoms that they name are not found in any one case. Secondly, I show from the report of Dr. Sharpe on the case of Mrs. Jones, that the bowels were acted upon in the commencement, and subsequently, that blackish and bloody stools were induced—and thirdly, we find that in eight persons poisoned with arsenic in Philadelphia, no mention is made of the action of the bowels of any, except the two that died, and they had no evacuations at all, and one that recovered had not been purged on the second day.

This I think is sufficient to identify the two in regard to the state of the bowels.

Wood and Bache say that there is a sensation of the teeth being on edge. In the first treatise we find the following: "The matter ejected is sometimes bilious; but much oftener sour, and so acrid that its action on the throat, in one case (which proved fatal) was likened to boiling water. Towards the close of mortal cases it is occasionally very dark coloured, so that it has been compared to that very convenient and fashionable object of similitude—coffee grounds, &c."—Here we have, in the first notice paid to the disease, the material to cause the teeth to feel as though they were on edge, although that circumstance is not mentioned. We have also the brown and offensive matters from the stomach, which is also characteristic of arsenical poisoning. We have in this same paper an account of the swelling of the surface. In speaking of the disease the author thus notices that symptom:

"The patient," he says, "remains languid, and his face and person generally becomes rather tumid."

We notice this symptom more particularly in this place because of its frequent attendance in cases where arsenic is known to be present and because it is a symptom not generally noticed by writers on milk-sickness.

All writers concur in relation to the disagreeableness of the breath of milk-sick patients, as well as in those who have been poisoned by arsenic.

Dr. Sharp in his letter, notices this circumstance thus: "I sometimes thought it faintly resembled the smell emitted from the milk of cows that had fed on young culinary vegetables, or buds of trees. At other times it has brought to my recollection the smell of young bruised garlic." This similitude between the breath of the milk-sick subject, and the fumes of metalic arsenic when in a state of vapour, which are known to impart an alliaceous or garlic-like odour, has not been noticed by any other writer except Dr. Sharp, so far as I have observed; but all agree that the odour is peculiar, and very offensive.

But knowing that this odour is resident in metalic arsenic and confiding in it as the cause of milk-sickness, it does not require a very great stretch of the imagination to arrive at the belief that this odour might some times be detected in the breath, as it was respired warm from the lungs. We are fully aware, however, that the metal cannot be in a state of fusion while in the animal system, and that the alliaceous odour is distinguished, only, when in a state of high temperature; nevertheless, when we remember the infinitely minute separation of its particles that must take place, before it can permeate the animal tissues and intermingle with the blood, the belief, that this odour may be detected in the gaseous issues from the lungs, will not prove so heavy a tax upon our credulity as it might at a casual glance appear. And that arsenic and antimony, as well, perhaps, as other metalic preparations do enter the circulation, and in it, traverse the system, no man can doubt for a moment, who will credit the reports of M. Orfila, with many others, let his predilections for the tenets of modern sympathists be what they may.

The most uniform, of the primary symptoms of poisoning by arsenic, are, burning in the stomach, and up the œsophagus or swallow, intense nausea and vomiting, with great restlessness, insatiable thirst, prostration, cold or cool extremities, and a withered aspect of the surface generally, &c., and the very same symptoms characterize milk-sickness. I mean in full, recent, and well developed cases of both ailments, such as render our decisions unequivocal, that the above

enumeration will characterize both, the milk-sickness as certainly as the poisoning of arsenic.

We will find a considerable variation of those symptoms, caused by the different quantities of the legitimate poison, received by different individuals, in both cases; but, in greater or less degree, they are the invariable attendants in both affections.

Other symptoms also occur in both, modified by many circumstances, such as quantity, quality, age, idiosyncrasy, &c. &c.; but which are not, however, so invariably present as the former.

I will now present the symptoms of poisoning by arsenic, directly after it had been swallowed by the individuals residing in Philadelphia, to which I have before alluded. The symptoms of none but the first case are detailed, in as much as the symptoms in that one case constituted a brief of all. Here it follows:

1. "Constant Gigon, aged thirty years, slender frame and delicate constitution. Symptoms—Extremities cold, pulse at the wrist scarcely perceptible, extreme anxiety of countenance, constant vomiting, and great thirst, and violent pain in the epigastrium, increased by pressure; spasms in the lower extremities; no priapism or purging; intellect perfectly clear; tongue covered with a thick white fur, through which the red papillæ stood prominently, very much resembling the appearance of the tongue in severe cases of scarlatina." The narrator stops here, and commences giving the treatment, which was of but short duration, as the patient survived only seven hours after swollowing the poison. It should be mentioned here, that this symptom of cramp of the legs has often been noticed in persons affected with milk-sickness, as it is mentioned as one of the characteristics of the malady, in the first treatise published in 1818, and also, by Professor Drake, in his recent Memoir on the disease.

The second case mentioned, among the eight that were poisoned, was Madeline Cetter, in whom the symptoms, at first, were milder than they were in the case of Gigon; but they soon became violent, were the same; and she died in nine hours from the time that she took the arsenic. The other six recovered.

As these two did not run through the course that patients usually do, from poisoning with this substance, it behooves us, if we wish to identify the two, to present at least one case of milk-sickness that terminated in the same way; and fortunately we have one at hand that is in point. In the third number of the last year's volume of the Louisville or Western Medical and Surgical Journal, we find the following interesting case, reported by W. J. Barbee, M. D., late of Marshall, Illinois.

Dr. Barbee says: "Mr. F——, a traveler, had been riding through a "milk-sick" region and treated the matter as a humbug, declaring that he was not afraid to eat any butter, or drink any milk that might be placed before him. I was called to him about 11 o'clock at night; he was attacked at dark, and according to the description of the bystanders, complained at first of giddiness and weakness, became stupid and indisposed to move. In the course of an hour, he said he was burning up at the stomach, and shortly after vomiting commenced. This continued till near the time of my arrival, when he was so completely exhausted that he could not speak. I could scarcely feel his pulse—the extremities were cold, and his breathing scarcely audible. In about an hour, from the time that I reached the house, he died."

Now we have three cases, two of which were known to have been occasioned by arsenic, while the other was known to be the milk-sickness. All three died beyond a doubt, from the direct effects of the poison upon the nervous system, in about the same length of time with the same general symptoms; and with the same pathological features as we will see, when we examine the reports containing the accounts of their respective autopsies.

That arsenic will sometimes destroy life thus suddenly, by an overwhelming depression of the nervous energies, in the course of a few hours, is a fact to which Wood & Bache, in common with all writers on the subject testify, and which is strikingly exemplified in the cases that occurred in Philadelphia; while in other instances, cases will ter-

minate, either favourably, or fatally, at all periods, from a few hours up to eight, ten, or twelve days, as is handsomely illustrated, also, by the reports on the six that recovered in the same family in Philadelphia.

This same variety of periods, in duration, and termination, obtains in, and strikingly characterizes, the milk-sickness, as we see from the report of Dr. Barbee, that Mr. F. died of it in a very few hours, while a vast number of others are reported to have lasted twenty-four hours, some forty-eight, sixty, and so on, up to ten, or twelve days. In this respect, the two maintain a marked and striking identity.

They resemble each other again in another respect. Before the introduction of the hydrated peroxide of iron, as an antidote for arsenic, and ever since, (it is so to some extent,) those who were once poisoned by it, scarcely ever attained to the enjoyment of perfect health afterward; and though they were restored to their feet again, yet it was only to linger out rather a painful existence, than to enjoy life; and this is precisely the case with those once afflicted by milk-sickness. A person cannot be found, who was once under the influence of this poison, that will declare him, or herself, as the case may be, to be as hale, robust, and healthy, as they were before having the disease.

Professor Drake, as well as some others, assert, that a common declaration with those who have suffered with the disease, is, that "I am not the man I was before I had milk-sickness;" and I know this to be true, from what I have seen and heard in regions where this disease abounds.

I could embody much more proof of the identity of the disease in question, with poisoning by arsenic, by adducing and comparing the symptoms, as declared by the many writers that have appeared on the disease; but I decline doing so, because I think the matter clear enough; and also, because those reports, from which I extract, are in print, and can be read by any or all that may wish to do so.

I will only remark here, that Dr. Barbee of Illinois, reported a se-

cond case, a Mr. D., in which spasmodic action of the bowels was prominently manifested; and in number second, volume tenth, of the Transylvania Journal of Medicine, in his Thesis on milk-sickness, Dr. J. Newton Smith, notices black, offensive stools, as a characteristic in the disease, and in Dr. Drake's memoir, the red, fiery, and raw looking tongue is mentioned, and also the great retraction of the umbilicus towards the spine. The three first named are reputed to be symptomatic of poisoning by arsenic, and the last will be found in keeping with some cases of the same kind.

For the purpose of further investigation into their identity, we will next take a view of the pathology of the two affections as reported by the physicians who made the respective post-mortem examinations. And here, I cannot but express my regret that I have not more well authenticated reports, on both diseases; but a few, only, will serve to show their identity, which I conceive will be observed and appreciated by all who will only take the trouble to compare them.

I will present the morbid appearances observed in the two cases that were poisoned by arsenic in the city of Philadelphia, and the one examined and reported by Dr. Barbee of illinois, that died from the poison of milk-sickness. I will give the reports in each of the respective writer's own words; and, first, in the autopsy of Constant Gigon, sixteen hours after death, the following appearances were manifest:

"All the muscles were firmly contracted, though the body had been kept in a warm room. There was not the slightest relaxation of the walls of the abdomen, which were drawn inward and so elastic as to feel stretched like the head of a drum. The stomach and duodenum were first removed, with a ligature applied to each orifice to retain the contents. On being opened the stomach was found to contain nearly a pint of a brown viscid fluid, which was reserved for chemical examination. The whole mucous membrane was injected, and of a bright scarlet colour, with effusion of lymph in some parts. No ulceration. On attempting to detach strips, the stomach was found

thickened and softened for the space of three inches round the pylorus. The mucous follicles enlarged. Several bright patches, from an inch to two inches in diameter, formed round a central point of irritation. Around the pylorus also, were several ecchymosed spots, from half an inch to an inch in diameter, and a few white points on the mucous membrane. The duodenum was injected only for an inch or two beyond the pylorus, but in a much less degree than the stomach. The mucous membrane of the fauces and œsophagus was considerably injected. The other intestines in a perfectly healthy state."

We will next see the appearaces on dissection, presented in the case of Madaline Cetter. Autopsy 13 hours after death.

"The same powerful contraction of the muscular system as in the foregoing case. The stomach contained half a pint of yellowish, turbid fluid. The mucous membrane much less injected than in case first, though near the pylorus there was a spot two inches square, intensely scarlet, and very minutely injected. Several small spots, similar in appearance, and from two to three lines in extent, were found in other places. The large veins could be seen through the membrane, very much distended. The duodenum and other intestines, not in the least affected."

Such are the appearances of those that die suddenly from the poison of arsenic, when examined internally, post mortem, according to the above reports; and we will next present an account of the appearances after death, in the person of Mr. F——, the traveler who fell a victim to Milk-Sickness, as contained in the account given by Dr. Barbee. It follows in Dr. Barbee's own words:

"Autopsy of Mr. F——. External appearance emaciated; physiognomy frightful; looked like an old man of eighty. Cavity of the abdomen. Stomach, muscular coat natural; colon puckered and so contracted as to shorten the longitudinal diameter; cardiac and pyloric orifices rigid; mucous coat deep red and thickened in spots, balance presenting a rather pale and softened appearance. Duo-

duodenum, jejunum and ileum, in their peritoneal covering inflamed. Colon, descending portion contracted to near the size of a common candle; two very narrow places; and about two inches above the sigmoid flexure, there was a partial intussusception. Mucous coat of the bronchiæ very red. Lungs contained considerable black blood, &c."

We have now before us the pathological manifestations of two well marked cases of poisoning by arsenic, and one equally well marked case of poisoning by the milk-sick virus, all three of which died in about the same length of time, with identical symptoms, and we find the morbid aspects to be nearly the same, as is revealed in their respective autopsies.

The stomachs of all three were (cæteris parabus) in a precisely similar condition, while the mucous coat of the duodenum, or first portion of intestine, was partially injected in the case of Gigon. In Madeline Cetter, the same portion of intestine was sound, while in Mr. F., the milk-sick victim, the mucous coat of the duodenum was unaffected, while its peritoneal or outer coat, together with that of the other two portions of small bowels was inflamed. In the two cases of absolute poisoning by arsenic, we find as great difference, in the effects on the *duodena,* as there is between those two and that of the milk-sick martyr; hence, I see nothing here to drive me from my position. But the colon, or middle portion of the large bowels, was reduced in caliber and shortened in its longitudinal dimension, by the contraction of its muscular coat, or fibres, in the man that died of milk-sickness; and this same portion was said to possess a normal appearance in those that died from arsenic. Now it will be borne in mind, that the mucous, or internal coat of the stomach and intestines, of those that were poisoned with arsenic, is the only one spoken of in those two cases; and as the extent of inflammation or engorgement, in those parts to which the arsenic was immediately applied, seems to have been the primary object of those who made the dissections, it is highly probable that the contracted state of the muscular coat of the large bowels es-

caped their observation, or if it was observed at all, was only supposed (and very justly too,) to be in unison with the muscular system in general, and not worthy of a separate notice. That more or less contraction in this coat of the intestinal canal was present, there can be no doubt. I would put the matter to the test of any physician's judgment, and let him say, whether or not, any cause that was capable of producing in the muscles of the body, and extremities generally, such rigid contractions as to warrant their comparison to the head of a drum, would not also similarly affect the same tissue in the intestinal tube, and willingly abide the conclusion. There can be but one answer given. We find, then, a remarkable correspondence in the condition of the muscular systems of the three.

It is stated that the bronchiæ and air-cells in the lungs of Mr. F. were much injected; but nothing is mentioned in relation to any portion of the lungs in the cases by arsenic; but every physician knows that arsenic will act in that way upon the lungs, and hence we decline noticing that indication any further, and will merely remark, that these cases were manifestly analagous, in history, symptomatology, duration, and pathology.

Sight must not be lost of the fact, that these three cases all sunk under the first impressions of the poison, made directly upon the nerves and blood vessels, which very often obtains; at least many suppose that arsenic often destroys life by a direct prostration of the nervous system, and consequent suspension of its influence, while many others contend that its primary effect is upon the blood, deterioates it and incapacitates it for supporting animal life, or, to be more explicit, that it enters the circulation, and then directly impresses the nervous system, causing a suspension of the functions of the brain and heart.

That arsenic does often overwhelm and totally destroy the energy of the nervous tissue, and that too very speedily, is abundantly clear and certain, whether its action upon that tissue be direct or secondary, or death would not so quickly follow its ingestion. The fact, that arsenic enters the blood, cannot be questioned, if we credit the asser-

tions of Brodie, Spraegel, Jaeger, Hunter, Home, and Mr. Orfila. They have shown conclusively, that arsenic does enter the blood. Jaeger thinks its action on the system similar to the poison of the viper, ticunas, &c.; and of the effects of the Ticunas, I cannot speak further, than that it is a highly poisonous substance, with which the aborigines of America used to poison their arrows, which, combined with the certainty with which they were shot, rendered them both formidable and deadly weapons.

As the poison that produces milk-sickness, and that of the viper, rattlesnake, &c., bear to each other a peculiar resemblance in some respects, I cannot pass the matter by without giving it some notice. I wish it distinctly recollected, that this Dr. George F. Jaeger entertained the belief, that the arsenic produced effects similar to that of the viper, and as the poison of the viper and rattlesnake are analagous, I will notice some features of resemblance between the poison of the serpent and that of milk-sickness, in order to corroborate, and further substantiate, the position, "that arsenic is the cause of the disease."

It is known to all, who have any understanding of the disease, that the cow, mare, ewe, and bitch, &c., will rarely if ever die of the trembles, or milk-sickness, as long as they are milked cleanly, or while they nurse or suckle their young; while those who use the milk, as well as the young of either animal, will perish by its use. In this respect, the poison that occasions milk-sickness acts similarly to the poison of the serpent, as we will see, by comparing a few cases that were bitten, with the milk-sickness.

Dr. McCall, whom I mentioned before, in a letter to Dr. Samuel Brown, gave the case of a child which he saw, that had been bitten by the rattlesnake; and also the case of a lady, reported by Dr. S. T. Barstow, in the third volume of Coxes's Medical Museum, in May, 1806; and inasmuch as the poison of the viper in Europe, and other ancient countries, is similar to that of the rattlesnake of *America*, and as there are some features of remarkable correspondence in the

poison of that serpent and milk-sickness, I will notice those two cases in Dr. McCall's letter, wishing the reader, however, to bear in mind the conclusions of Dr. Jaeger, in relation to the effects of arsenic, which, I contend, is the cause of milk-sickness. Dr. McCall says: "I saw a child having its skin much discoloured with yellow and dark spots. Its parents stated, that about one year previous it was bitten by a rattlesnake—that a discolouration similar to that it then had, occurred soon after it was bitten—that the spots had disappeared during the winter, and they supposed it to be restored to health, but when the season approached in which it was bitten, the skin again became discoloured, and its extremities swelled. The child died." Here we see that the poison was absorbed and retained in the system twele months dormant; but as soon as the season with other contingencies combined to favor its development, the disease again recurred; of which the patient died, which is frequently the case with milk-sickness, as will be seen from the concurrent testimony of many. This, then, forms one of the features, in which I conclude the effects of arsenic and those of the serpent, resemble each other. Again, in the quotation from Dr. Barstow, we find the following:

"Some time in the summer of 1801, the wife of Mr. Alfred Bremin, in the town of Baintrim, Luzern county, Pennsylvania, was bitten by a rattlesnake. She was then in the fourth month of pregnancy. After some considerable degree of the common consequences of such an accident had occurred, she at length recovered. At the full time of delivery she was put to bed. The child was apparently healthy; but immediately after allowing it to suck, it assumed the hues of a rattlesnake, swelled very much and soon died. She then procured a puppy which died in two days of the same symptoms, and in succession one puppy and three lambs shared the same fate. Another puppy was procured which discovered but little of the symptoms and did not die. In 1803 she had another child, and no disagreeable symptoms resulted from the use of her milk."

In this last case we have not only an illustration of the fact that

the poison was absorbed and taken into the system; but that the lactic secretion afforded it an outlet in sufficient quantity to destroy the child, a puppy, and three lambs, while the mother entirely escaped injury. And this is strikingly the case with the mothers and young of the inferior animals in the milk-sickness.

In this respect, I think there is an analogy between arsenic and the poison of the snake, that will be fully proven when my position is tested by chemical analysis, and the result declared.

The virus that causes milk-sickness, as well as that of the rattle snake, viper, &c., seems to exercise peculiar elective affinity for the mamary glands, or else they possess peculiar ability in extracting poisonous substances of such a nature from the system; for their secretions are generally destructive to any animal that partakes of them.

That arsenic will thus affect the milk, butter, flesh, &c., of animals, I have no doubt; but it has not been fully demonstrated yet, for men have generally been experimenting with herbs, to its entire neglect. But that arsenic does at least poison the flesh of animals destroyed by it, I know to be true, from one circumstance which the observations of hundreds and perhaps thousands could attest; and this is, that rats that have been poisoned with arsenic, and suffered to lay about the yard, will destroy the chickens and turkeys, &c., which pick and feed upon them. This alone, proves that the substance gets into the flesh of animals, if we had no other testimony on the subject; but I think the different writers of whom I have already made mention, have made this fact clear, and I shall, therefore, decline giving any more arguments in support of it.

It remains for me to show, in the remainder of this treatise, that arsenic is at hand in the regions in which the milk-sickness abouuds.

On this subject I will call in the aid of Philips, Turner, and Black, and perhaps some other authors, by which, together with my own observations, I expect to show that the article in question, is much more abundant in the Southern and Western States than has been supposed, and that the stock, of various kinds, ranging in the valleys

and hills, can, and do take it into their systems without much effort.

The Geological differences, which I have already specified, I wish to be borne in mind, for I shall have to notice and apply them in this part of the subject.

Where then, and under what circumstances do we find arsenic?—It is sometimes found native, though rarely; but all the authors concur in the declaration that it occurs in combination with tin, zinc, copper, silver, iron, cobalt, nickel, lead, sulphur, stone-coal, bismuth, &c., also sometimes in some species of shale or slate. And the fact that the sulphuret of iron abounds in the coal or sand stone regions, and the milk-sickness abounding in them also, first directed my mind to the subject, and the further I pushed my inquiries, the more I became impressed with the conviction that arsenic was the agent.

For, while the exclusive limestone districts are exempt, we find some sand stone districts, also, exempt. We also find specimens of the different ores mentioned, occurring in many places where the milk-sickness is not known, and hence, neither of them can (per se) be the cause, and as the symptoms and pathology of milk-sickness correspond very nearly with those of arsenic, we may safely infer it to be the cause.

Dr. Black in his work on Chemistry speaks of it in the following mannner: "Arsenic is sometimes found pure, or in the form of solid metalic arsenic, but oftener more loosely concreted, like a grey or black friable matter. But pure arsenic in any shape is rare; though in the state of combination, there is plenty of it in the ores of metals, especially those of cobalt, copper, silver, and iron. In the white pyrites, it is known by the garlic smell when struck. It is most plentiful in this mineral and in the ore of cobalt." And a few lines further, he says, "Arsenic, for the use of the arts: is prepared chiefly from cobalt ores and white pyrites, as a secondary business only in the manufacture of zaffre and smalt." In as much as I suppose its combination to be the situation in which is found most fre-

quently in those regions in which the milk-sickness occurs, I will notice what Dr. Turner in his work on Chemistry says in relation to it. After giving a general history of iron and its compounds, he then goes into an individual history of its several preparations and compounds, and speaks of one in the following langugnage: "Bisulphuret of iron, iron pyrites of mineralogists, exists abundantly in the earth. It occurs in cubes or some allied form, has a yellow colour, metalic lustre, a density of 4.981, and is so hard that it strikes fire with the steel. *Some varieties* have a white colour; but these usual-contain *arsenic*. Others occur in rounded nodules, have a radiated structure divergent from a common centre, are often found in beds of clay, and are much disposed by the influence of air and moisture to yield sulphate of the oxide of iron."

Here we find the two authors concurring in the statement, that arsenic exists abundantly in the earth with other ores, but especially with that of iron, and in white iron pyrhites, and the spontaneous decomposition of the pyrhites, mentioned by Turner, is a fact, which I observed in my recent tour through Indiana. In Lawrence county, on the waters of Beaver creek, one of the tributaries of East White river, I made the most of my observations. I found the whole earth there to be full of the different specimens of iron ore, combined with the hard, bastard limestone, yellow and red sandstone, indurated clay or "soapstone," some shale or slate, blue clay, stonecoal, &c. We were informed by several gentlemen residing there, that lead ore had been found by different persons, also, on the surface of the earth. But the iron ore is abundant, the milk-sickness equally plenty, and numerous plantations are entirely depopulated, many having died of the milk-sickness, while others, after having lost more or less out of their families by this ailment, moved away, leaving their landed possessions in that section, free to any who may wish to occupy them.

The unanimous belief in that section is, that the disease is caused by some mineral substance; and I think it impossible for any man to

pass through that region, and arrive at any other opinion. The people speak of the poison springs there, as familiarly as we do of any other known subject. We visited many springs that had been fenced in or abandoned, and in nearly all of them, we found the white pyrites in abundance.

I have frequently seen the sulphate of iron formed upon the cubes or nodules; and to such an extent does it abound in this region, that it has been a common practice with the ladies of the settlement, after a very dry spell of weather, to gather it, dissolve the sulphate that forms on the outside of the lumps, and dye a good copperas colour with it.

The stonecoal is entirely useless, on account of the quantity of sulphur, iron, and arsenic, contained in it. We were informed, by numerous persons, that it contained this same white powder, as they termed it, the *copperas*, after it was exposed to the air. They all united in declaring, that in very wet or rainy weather, they had but few cases of milk-sickness, either in persons or stock; but that during very dry weather, they suffer, winter as well as summer; and that when light rains succeeded to the dry weather, it was always most abundant, until it was arrested by one good sweeping rain, which never failed to stop it forthwith. Here we see the philosophy of the matter at once; these pyrites, and other kinds of ore, during the dry weather effloresce, the sulphur, uniting with a portion of the oxygen of the air, forms the sulphuric acid, which converts the iron into a sulphate, or *copperas*, while the arsenic is either oxydized by the air, or remains in the form of a sulphuret; the light rains fall sufficient to dissolve the sulphate and a portion of the arsenic, it collects in ponds and the stock drink it, or lick at such places for the saline matter, and in this way they take in the arsenic in sufficient quantity to poison them. I conversed with the blacksmith of the neighborhood, (Mr. A. Coleman,) on the subject of the impurity of the stonecoal, and he informed me, that he had frequently tried its use, but that he could not work the iron heated by it, because it burned it up, and he said he had found none in the region that was fit for use on that account, though he had taken it from the

ground in many different places. I have also conversed with many other gentlemen, who have, in some of the arts and mechanical pursuits, employed large quantities of stonecoal, and they nearly all concur in the statement, that arsenic is often so abundant in it, as to render it unfit for use.

In this section of country, in Indiana, the milk-sickness is always feared in dry weather; but it is fearfully prevalent when small rains succeed a drought, and is arrested as soon as the earth's surface is well swept, or washed by a heavy rain. The settlers related many interesting occurrences, of which I will relate a few of the most prominent.

One plantation, known in the neighborhood as Crump's place, was entirely abandoned, and when we enquired into its history, together with its former occupants, the following narrative was related by several gentlemen, of whom I will mention Isom Burton, Nathaniel Brewer, Alexander Coleman, and Michael Marley. They said the place belonged to one Squire Crump—that during the very dry summer of 1838, the spring nearly dried up, and about that time, the stock being greatly afflicted with the trembles, Crump and four other members of his family were attacked with milk-sickness, of which they died, and that while they were sick and dying, the ducks, several of which were running in the yard, became afflicted in the same way, stiffened, were unable to walk, &c., and died. They were all convinced that the ducks obtained the poison in the little ponds of water contained in the spring branch, which did not flow off freely, but drained slowly through the clay, sand, pyrites, and coal, &c.

During the dry winter of '38–9, the creek (Beaver creek) became very dry, in so much, that the water only remained in some of the deepest holes in the channel, and while these were locked by ice, and the ground froze, and partially covered with snow, some of the cattle in the neighborhood, that run in the woods, were found to be affected with the trembles. They at once sought the watering place, at which the cattle drank, and this they found to be situated in the bottom of the channel of the creek. A small stream issued out of the bottom of

the bank, and ran a few feet over, and through the mud, sand, slate, pyrites, &c., in the bed of the creek, and then entered a pond standing in the bed of the creek.

They found that this place had been frequented by the cattle, by noticing their tracks in and around it, and at once supposed that to be the place at which they contracted the disease. That alone was sufficient to justify such a conclusion; but another circumstance rendered the supposition still more warranted and conclusive. They observed that the ice on the pond did not approach the shore immediately at the point where the water from the spring entered the pond.—This is only a common observation, for we all know that the water, as it issues from a spring, will run some distance and enter a larger body of water without freezing in its channel or suffering the ice to encroach upon the shore at the point at which it enters. But the remarkable circumstance that corroborated their supposition that the cows were poisoned at the little spring was, that the fish in the pond had assembled around the entrance of the stream, issuing from the bank, and were all dead. They said the dead fish at that point were innumerable, and that they afterward searched and could not find a living fish of any size in that pond, while in those above and below, in the channel, there were plenty to be seen. These facts were communicated to us by Solomon Dorset and his father, which were concurred in by Mr. William Connerly and others. The people in the settlement all concur in the belief that the cause of milk-sickness is contained in the water, and that it sometimes is on the herbage; and I think their views are correct, for when we consider the immense amount of pyrites, as well as many other species of iron ore, that are found even on the surface of the earth and that they are there decomposing, or rather effloresceing by the action of the air and moisture upon them, we can see at once that more or less of this substance is both likely and liable to attach to the vegetation, especially where light showers of rain fall and dissolve the sulphate of iron, and arsenic thus formed, and cause little puddles, holding it in solution, to stand among the herbage.

Many of them believe also, that persons take the disease from the use of the water from many of the springs when they afford but little water, without using either beef, milk, or butter, and this fact has often been noticed by medical writers. Guy M. Wright, M. D., in his treatise which I mentioned before, mentions this fact, and Cornelius McAnelly, M. D., also, corroborates the statement in his Inaugural, an extract from which, is contained in No. 1, Vol. 9th of the "Transylvania Journal of Medicine." Dr. McAnelly states that this frequently occurs in the vicinity of Johnstown, in the State of Ohio.

We visited a great number of springs that were enclosed with fences, as well as those at the places that were evacuated, and found in almost all of them the sulphuret of iron, or pyrites. One of the springs deserves notice from the fact that six different families had respectively tried the place, and more or less died in four of the families with milk-sickness, and the other two stayed but a short time on the premises. The spring did not afford much water, and in its channel we found great quantities of pyrites; even a layer of secondary limestone, which we found imbedded in the banks below, where the water broke out, and lying between two immense beds of indurated clay or "soapstone," contained an abundance of the sulphuret of iron, although it was not more than two inches thick at the edge that protruded, and from which we detached some pieces.

We were accompanied to this spring by Wm. Connerly, Adam Bruner, and Benjamin Evans. Mr. Bruner is a stone mason and resided a long time in the lower part of the state of Kentucky, near to Hardinsburg, where the milk-sickness prevails to a great extent, and he informed us that the stone in that part of Kentucky was precisely like that on Beaver creek in Indiana, viz: yellow and red sand stone containing a great abundance of iron, which rendered it very difficult to work. Mr. Bruner is a man of fine intelligence and sterling veracity, and he informed us that from that section which is on Beaver

creek, Lawrence county, in a south western direction, until we arrive at the Ohio river, we should find the milk-sickness to abound in many places. He said that he had passed over a large portion of that section, and that the same species of formation of stone occurred in every place where the disease occurred. He stated further, that in the range leading to the Ohio, we should sometimes find small sections containing good limestone, and that wherever that was the case we should find no milk-sickness. This declaration was substantiated by our own observations in part of that region. Through the entire range, wherever the limestone is found, the disease is not known; but where ever the yellow and red sand stone and pyrites is found, there the milk-sickness rages, and is especially abundant on the waters of Pattoca, a small tributary of East White River. From what I have said in relation to the sections that suffer with the disease, some might suppose that they are generally level; but this is not the case with the localities generally which I have visited, nor is it so with a majority of the sections in which the disease prevails. In Lawrence, Orange, Floyd, and Harrison counties, in Indiana, where the disease abounds most, the land is broken and irregular. The hills are very high at some points, and the springs issue from the bases of some; while others, again, break out one fourth or one half way from the base to the top, &c. The growth of timber is such as we would expect to find on such land as contains such substances as we have noticed, consisting of oak, hickory, young poplar, elm, sassafras, &c. From the point of which I have spoken, in Lawrence county, we passed into Orange and made some examinations south west of Paoli. In this section we found the same formation of stone, clay, &c., together with the pyrites and other species of iron ore, plentifully though not so abundant as in the Beaver creek settlement in Lawrence county. We were informed that lead ore had also been found in different places in this section.

On our return we stopped with Judge Chambers, who lives on the road leading from Louisville to Vincennes. The Judge, who is a

very intelligent man, gave us much information of sections in his county, though not immediately in his neighborhood. He informed us that at the distance of two and a half or three miles north east of him there was a settlement, in a section called Wolf valley. In this settlement in the valley, he said the water became very scarce for stock in dry seasons. During the drought of 1838, the stock in the neighborhood had to go a considerable distance to get water, and then they obtained it in but small quantities, as they drank or rather sucked the water as it drained down a small ravine making into the valley. While this constituted the chief watering place for the cattle owned by the people, residing in the valley, they suffered with milk-sickness and many of the cattle died. During the prevalence of the disease he saw and conversed with some of the settlers in the valley, and on being informed of the circumstance, he advised them to assemble and fill the ravine by falling timber into it so as to prohibit the ingress of cattle to the water. They did so immediately and the disease subsided speedily, and there has not been a case of the ailment in the valley since.

He also stated that, at the distance of three miles, south west of him, the disease prevailed more or less every year. This section is on the head waters of Pattoca; and he told us that he could fill a waggon-body with the pyrites that lay in the springs in that settlement.

Every person with whom I conversed, stated that the disease was of much rarer occurrence in wet seasons than during dry ones; and in many localities where it obtained in dry seasons, it was not known during wet ones. This circumstance is easily explained. During the wet seasons, the springs and rivulets are kept flush, and unless there be an immense quantity of arsenic in the earth, its solution is so diluted as not to be injurious. But during rainy weather, and when the earth is saturated with water, it is found in many places issuing from the ground where there are no regular springs. These issues often pass through the different beds of metalic substances and

dissolve a portion of the poison, which, from there being but little water, is poisonous to the cattle that drink it, as it stands in small ponds on the surface of the ground.

It is not contended that the regions which contain iron ore are the only ones which afford milk-sickness. Far from it. For we find it occur in sections where the iron ore is not found. Again, it is a fact, which makes a part of the history of the Western and Southern States, that they contain a great quantity of the ores of the different metals mentioned, and which contain arsenic.

In Professor Drake's Memoir on the disease, he mentions the discovery of blende, or sulphuret of zinc, as an imbedded substance in that portion of Ohio to which his observations were confined last year. And we will see what Turner says on that subject.

In Turner's Chemistry, (page 342), article Zinc, we find the following: "In commerce, it is often called *speeter*, and is obtained either from *calamine*, native carbonate of zinc, or from the native sulphuret, *zinc blende* of mineralogists." After speaking of the methods of extracting the metal, he says: "The first is commonly very impure, containing cadmium and *arsenic*," &c. Here we find the zinc blende, mentioned by Dr. Drake, existing in the earth, in the district subjected to his perambulations; and we hear Turner assert in broad terms, that "arsenic" is generally connected with the zinc in that state, as well as in the calamine, or native carbonate.

The topography, botany, and geology, of that portion of Ohio of which Professor Drake speaks, are all in unison with the general statements made in relation to milk-sick regions.

The great and embarrassing difficulty, in deciding the question as to the cause of the disease, has been, that no mineral substances have been observed at some points, where the disease obtains, while at others, iron has been found; copper at others; lead, zinc, cobalt, bismuth, sulphur, &c., at others; without taking cognizance of the fact, that arsenic is frequently contained in all of these substances.—It would be very absurd, indeed, to suppose that all of these several

metals would give rise to a disease so uniform in its character, as "milk-sickness." This could not be, even if they were all poisonous, which, however, is not the case; for nearly all of the feruginous preparations are safe and useful agents in the cure of many diseases; so, also, is sulphur, &c.; while none of the others are, *per se*, so violently poisonous, as to produce such effects as are exhibited in the milk-sickness. But when we remember that arsenic, that potent destroyer, is frequently found in combination with the ores of the many different metalic substances, and one or more of these is almost always found in "milk-sick" districts, we can at once see the cause of the disease.

In looking into the history of those several mineral formations, we find that they occur principally in coal or spurious lime-stone districts; while in the purely lime-stone regions, they rarely occur, in any thing like quantity. So it is with milk-sickness; for it rarely, if ever, appears in lime-stone lands. I know of no instance of its occurrence in such a locality.

There is another good reason, why the lime-stone regions are exempt from milk-sickness, even should the ores containing the arsenic be found in the lime-stone formations. It is, that the arsenic, which I suppose to be principally in the form of arsenious acid, unites readily with lime, and forms with it a salt, or salts, which is insoluble, or nearly so, and which is consequently, but very partially, if at all poisonous. We find in Hooper's Medical Dictionary the following remarks on the subject:

"The arsenious acid combines with the earthy and alkaline bases, forming arsenites. The earthy arseniates possess little solubility; and hence the solutions of barytes, strontian and *lime*, form precipitates with that of arsenious acid."

It is worthy of remark, that the author probably used the word *arseniates*, instead of *arsenites*, in the above; for he speaks of the combinations of arsenious acid only; while the *arsenic* acid would denote the *arseniates*, according to the modern nomenclature of chemical science.

We are further aware of the protective influence of lime against that of arsenic, from the fact, that lime-water has long stood amongst the class of antidotes for arsenical poisoning. This alone would tend very much to exempt the lime-stone sections from milk-sickness, even if the arsenicated ores did exist in them.

This geological distinction is prominent, and should not be forgotten by any one; especially by those intending to settle in any of the yet unattested portions of the South and West.

It is a well known fact, that where an ore is embedded, containing arsenic, that more or less of the arsenic will be converted into an oxide, by the decomposition of some of the water that passes through such substances thus imbedded, and hence I am disposed to think that the white oxide is the chief form of the metal that causes the milk-sickness. But other salts or admixtures of arsenic, such as the sulphate, sulphuret, &c., may, and probably do, also enter with the oxide. They are highly poisonous, and are capable of destroying life, as well as the oxide, and it is highly probable that they at least contribute something in the creation of the disease.

In the foregoing pages, I think it will be seen, that the symptoms of milk-sickness are nearly similar to those caused by arsenic; the pathology of the two are also shown to be identical. We find the geological features of the milk-sick districts, to correspond with those containing more or less of the mineral substances with which arsenic is generally combined; and we find, by analysis, that arsenic is absolutely present in the iron pyrites that we found in the milk-sick district, on Beaver creek, in Lawrence county, Indiana, and also in Orange county, south-west of Paoli. And when we compare all these, together with the circumstances in general that attend the milk-sickness, with poisoning by arsenic, the identity of the one with the other is abundantly apparent.

While traveling through the different portions of Indiana, where the disease is so abundant, I gathered a considerable quantity of the iron pyrites, or sulphuret of iron, and also other specimens of the ore,

which I have submitted to many different persons who are judges of ores, and they generally concurred in the belief, that arsenic was present in them; but this was not satisfactory, therefore, I, in person, submitted them to Professor J. Locke, of Cincinnati, on the 15th inst., and by analysis, the presence of arsenic was demonstrated.

I will here insert Dr. Locke's process and results in his own words, which are as follows: "After pulverizing the pyrites in an agate mortar, and oxygenating it with fuming nitric acid, I applied Marsh's test by hydrogen, and obtained the true arsenical spot, or speculum, on porcelain. The materials were all tested previous to the experiment, &c. J. Locke."

*Cincinnati, July*, 15, 1841.

By the assistance of Mr. A. Peter, of Louisville, I obtained the same result, by the same process employed by Professor Locke, in the presence of Mr. J. George and others.

When I was in the state of Indiana, the springs were so flush with water, caused by recent rains, that I thought it useless to attempt to analyze it; and there were no cases of the disease at that time, to afford an opportunity to test the contents of the stomach, or secretions, consequently I was deprived of these two essentials in point of proof.

Such are my views in relation to the cause of milk-sickness, and such are *some* of the evidences upon which my belief is predicated. I could adduce much more proof in support of my position, than I have done in this essay, but I think I have said enough to show the validity of the position, and also to call the attention of physicians to the subject, and cause them to give it a fair, unbiased, and impartial examination. There is yet one important consideration to be attained, and that will be effected by the analysis of water and the contents of the stomachs, as well as the different excretions of animals that have the disease.

Before leaving the subject entirely, I will notice a few objections that will be urged against the position that I occupy, and which I have endeavored to sustain in this treatise.

It is stated by some, that bringing the soil under the dominion of the plough completely eradicates the poison, and renders it safe for pasture forever, after a few years' cultivation. Now this assumption is not sustained by facts, nor can it be fully sustained, until the entire districts, in which the disease abounds, are brought into cultivation; for, in many instances, there may be but a few streams, ponds, or licks, in a district that afford the poison, and as long as they are left without the enclosure, the stock kept within the enclosures, of course will escape the disease.

Again it is said, that the disease has been known to occur on portions of land which, when enclosed by fencing, did not produce it. In reply to this objection, I will only say, that we cannot suppose that the noxious agent is possessed of locomotive abilities that would enable it to escape from the grounds as soon as they are fenced in; nor can any one tell, in many instances, the exact point at which the stock, ranging at large, contracts the poison that causes the disease. Their carcases being found in a certain locality, does not prove that they there got the poison, for they may be found dead miles from the place at which they got the poison.

But we have many authentic statements and observations on record, which contradict the assertion, that "the clearing, fencing, and cultivation of the ground destroys the poison." Dr. McAnelly, whom I before noticed, refers to facts and occurrences in the neighborhood of Johnstown, Ohio, which militate directly against the assertion; and in the regions in Indiana, of which I have spoken, we can find enough facts contradictory of the assumption; the people there think, that keeping the cattle up, protects them very much from liability to the disease, and hence they keep their cattle (milch-cows especially) up, during the latter part of the summer season and the early autumnal months; but with all this precaution on their part, the cattle sometimes die within the pastures with the disease, and notwithstanding they use the milk of none but from those that are kept in the pastures, yet more or less of the inhabitants have the disease annually; and

they also have to exercise care in selecting the pasture ground, employing such only as are well supplied with water from springs or rivulets that run flushly, avoiding all sites that are not thus watered, but which contain small ponds, or weak springs, &c.

In the lower counties in this state the same thing obtains; the stock have the disease and die of it, while they are enclosed in the pastures.

Again it is said, "that clover destroys the poison." I cannot think that it destroys it; but I think it, as well as all other kinds of succulent herbage, will tend very greatly to counteract the poison, when it is used plentifully; for first, the cattle feeding on clover and the grasses, &c., drink but little water, and hence take in but little of the poison; and secondly, the clover as well as all the different kinds of grass, used for pasture, has an aperient or rather purgative effect upon the bowels of the stock, especially in the early part of the grazing season. In this way, I think, we can satisfactorily account for the apparent immunity by clover and the grasses.

But some say that cattle will not have the trembles, if they are salted regularly every day, or every other day. This is very probably true, in many respects, and in many situations; for when the stock obtain the poison from a lick, or any other such place of resort, they would have no inducement to draw them to such a place, if they had the necessary quantity of salt given to them at home. And again; from the known (though small) affinity existing between arsenic and soda, which is the base of the common salt, the arsenic *may be*, to some extent, neutralized or changed into a less poisonous form, by the free and frequent exhibition of the salt.

Such are some of the objections that will be, and are, urged against the ground which I occupy; but they do not, in my view, affect the proposition injuriously, but rather strengthen it in some respects. I will only add in conclusion, on this part of the subject, that the matter will be fully and fairly tested during the present season, as I intend to subject the contents of the stomachs, as well as the milk, urine, &c., of animals that have the disease, to chemical analysis;

and here I feel justified in calling on the members of the medical profession, to contribute to the establishment of the proposition by this last and final test.

It will be recollected that the symptoms of milk-sickness are identical with those occasioned by the exhibition of poisonous portions of arsenic. The pathology of the two are also the same.

I have shown that arsenic is often present with the ores of metals that are generally found in the milk-sick districts, both by the assertions of authors and by analysis, and of course I think the proposition well and fully sustained by the investigation thus far.

For the purpose of impressing the geological differences upon the minds of those who may read this, I will notice that part of the subject again, and will again assert, that the good pure limestone sections will not suffer with the milk-sickness; but where the inferior qualities of the limestone occur, in common with the sandstone, coal, indurated clay, and the ores of some one or more of the metals before mentioned, we find the disease.

We find the secondary, as well as the magnesian limestone, occurring in greater or less quantity in all the milk-sick regions, besides the red and yellow sandstone. These kinds of spurious limestone constitute the matrix of the different ores which I have mentioned as containing arsenic in combination with them. We find these substances fully treated of in the writings of geologists, under the head of the coal formations, or coal regions.

This kind of formation is common in Ohio, near Columbus, Dayton, &c., where the disease is common; it is likewise common in the different sections of Indiana, and in every quarter where the disease obtains, so far as I have been able to ascertain. And as those who wish to study these matters fully can do so, by applying to the works on geology and mineralogy already in print, I will decline further remarks on the subject at present.

In this treatise I have presented facts which are new, or, at least, such as have not before been mentioned by writers on milk-sickness.

They will be found true and substantial characteristics of milk-sick districs, and hence I expect them to be acknowledged and appreciated. But my opinions, as couched in this treatise, are subject to be reviewed and criticised, by any who may feel inclined to do so. I feel safe in declaring my willingness to defend the proposition, that arsenic is the proximate cause of the milk-sickness, for I fearlessly assert my unhesitating conviction of its truth, and that it can be sustained by undoubted testimony.

With this much said on the subject, I am willing for the present to submit the whole to the public, and await their decision. For presenting this treatise, however, to the public, I have no other reason, nor apology to offer, than that the subject is both interesting and important. And for the brief and irregular manner in which I have treated, at least some parts of it, I can only say, in my own behalf, that I have been compelled to throw it together at such intervals as have occurred, to relieve me from the united cares of my practise and my plantation.

I will only say, in conclusion, that I decide that arsenic is the chief cause of milk-sickness; while in conjunction with it the salts of iron, copper, zinc, lead, &c., do sometimes enter also, and modify, to some extent, the symptoms of the disease; which view is greatly strengthened, and the proposition itself rendered doubly plausible, when we remember the facility with which poisonous substances, in a state of solution, are concentrated by spontaneous evaporation in our climate.

We often see considerable streams issue from the earth, and before they pass to the distance of forty or fifty yards, over the beds of their channels, we do not see more than half the quantity observed at the points at which they make their exit from the ground; and with a knowledge of this fact, we can at once see why the streams are supposed to be more poisonous at places a little more remote from the places at which they come forth, also the reason why ponds should present the same difference at different seasons, &c.

In the evaporation of any *fixed* substance held in solution, it is the aqueous portion only that is eliminated or thrown off, while the substance held in solution is concentrated by the process in an exact ratio to the quantity of water carried away. But this law of evaporation is so generally understood, and so frequently employed, by even the most illiterate, in preparing salt, sugar, soap, &c., that I deem it useless to add any thing more on the subject; and I will, therefore, dismiss it, supposing that all will see and appreciate the plausibility of the main proposition, when they consider this *one* principle an interesting fact.

In this treatise, I have employed the terms milk-sickness, endemic, sick-stomach, and trembles, as synonymous appellations for the same disease, as they are all used by the people, at different points, to signify the same thing. Either of them, and all of them, are equally significant of the disease; but I gave precedence to the term used in the title page, because it is most commonly employed.

In these pages I have avoided the insertion of technical phrases, as far as consistency with the subject would allow, for the purpose of adapting them to the capacities and understanding of the *common* reader, as well as the more erudite and scientific of the western citizens; and if I have succeeded in rendering it susceptible of ready comprehension, by the farmer and mechanic, I have achieved *one* object that influenced me in making this publication.